

MONTHLY WEATHER REVIEW,

DECEMBER, 1880.

(General Weather Service of the United States.)

WAR DEPARTMENT,

Office of the Chief Signal Officer,

DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

In preparing this REVIEW the following data, received up to January 20th, have been used, viz: the regular tri-daily weather charts, containing the data of simultaneous observations taken at 144 Signal Service stations and 14 Canadian stations, as telegraphed to this office; 182 monthly journals and 168 monthly means from the former, and 14 monthly means from the latter; reports from 3 Sunset stations; 248 monthly registers from Voluntary Observers; 60 monthly registers from United States Army Post Surgeons; Marine Records; International Simultaneous Observations; monthly reports from Voluntary Observers in, and the local Weather Services of Iowa and Missouri and of the Central Pacific Railway Co.; reliable newspaper extracts; special reports.

BAROMETRIC PRESSURE.

Upon Chart No. II is shown by the isobaric lines (in black), the distribution of atmospheric pressures over the United States for December, 1880. The area of highest pressure lies somewhat farther westward than usual and covers the greater part of the country from the Mississippi valley westward to the eastern Rocky Mountain slope. On the Pacific slope, the high-pressure prevailed on the southern instead of the northern coast.

Departures from Normal Values for the Month.—By comparison with the average for the past eight or nine years, it is found that the barometric pressure for December, 1880, ranged from 0.05 inch to 0.10 below the mean in the Atlantic States; greatest departures, —0.10 at Norfolk and Wilmington, and —0.12 at New Haven and Wood's Holl. Over the Missouri and Upper Mississippi valleys, an equal excess of pressure prevailed; greatest departures, +0.05 inch at Keokuk, La Crosse and St. Paul in the latter, and +0.11 at Bismarck and Yankton in the former, district. On the Pacific coast, the pressure was normal at San Diego, 0.10 below it at San Francisco, and 0.24 below at Portland, Oregon.

Local Barometric Ranges, from readings reduced to sea-level, were greater than usual, and exceeded 0.75 inch over the entire country, except southern Florida, southern California and at a few scattered stations in the southern Plateau district. The ranges in the Atlantic and Gulf States generally varied but little from 1.00 inch. The greatest ranges were in that portion of the Lake region and Upper Mississippi valley, over which the centre of low-area No. V passed; they increased gradually northeastward from 1.47 at Leavenworth to 1.79 (the largest in the country) at Escanaba. The smallest range was 0.49 at Key West. Other noticeable ranges were 1.70 at Dodge City, 1.48 at Missoula and 1.27 at Umatilla.

General Barometric Range.—The extreme range of the atmospheric pressure, reduced to sea-level, was 2.15 inches, from 30.97 at Fort Buford on the 26th, to 28.82 at Dodge City on the 4th.

Areas of High Pressure during December, 1880, were eight in number, three of which were slight and unimportant encroachments of high pressures from the Pacific ocean. The five other

areas were outflows of very cold air from the British possessions, and, except No. V, (which seems to have moved southward from Hudson Bay region) advanced southeastward apparently from Saskatchewan. No. VIII was the most important area, its passage being marked from the 24th to the 31st by excessively low temperatures which materially reduced the mean temperature of the month, and made in many sections the last half of the month the coldest for many years.

No. I.—first showed itself as a rising pressure in the valley of the Upper Missouri on the 1st, and moving slowly eastward through the Lake region, was central in the Upper St. Lawrence valley the afternoon of the 3rd. During the 4th it withdrew southeastward off the Atlantic coast in advance of low area No. IV. The highest pressure in connection with the area was that at Fort Buford on the morning of the 2nd, 0.40 above the normal. Cautionary Signals were displayed during the 1st in the Lake region and were justified on Lake Michigan: greatest wind velocity W. 29 miles at Milwaukee. The Signal displayed at Eastport was justified by a north wind of 30 miles. In connection with this area a temperature of -25° was reported from Ft. Buford on the morning of the 3rd.

No. II.—During the 5th the pressure in the valley of the Upper Missouri rose above the normal and the area, moving slowly southeastward, on the morning of the 7th covered the Mississippi valley; Cairo barometer 30.61, or 0.40 above the normal. Withdrawing southeastward the area was slowly dissipating over the Gulf of Mexico, when it was re-enforced by high area No. III. Off-shore signals were displayed on the Texas coast during the 5th and 6th. This signal was fully justified at Galveston, but at Indianola for velocity only. The lowest temperature reported was from Fort Buford on the morning of the 6th, -37° .

No. III.—This area first appeared in the same district as the two preceding areas—the valley of the Upper Missouri. It was central during the 9th in the Upper Mississippi valley, and moving slowly eastward was in the Lake region on the 10th; Parry Sound barometer that morning 30.77 or 0.66 above the normal. Thence it moved southward through the Atlantic States and slowly withdrew from Florida eastward, or dissipated on the 11th. Cautionary Signals were displayed in the Lake region and along the New Jersey (as Off-shore,) and North Carolina coasts on the 8th. These signals were fully justified along the Atlantic coast and partly in the Lake region. The following were the highest winds reported: Buffalo N. 28, Milwaukee NW. 32, Sandusky W. 35; Cape May N. 44 and Kittyhawk N. 53. Cautionary Signals were again displayed on the North Carolina coast during the 10th, and as Off-shore from Chincoteague to Portsmouth, N. H. These Signals were fully justified, though somewhat late at all stations north of Sandy Hook. The following are the greatest wind velocities reported: Chincoteague NW. 30, Cape May NW. 44, Cape Henry NW. 46 and Newport N. 48. The lowest temperature of this area was -27° at Fort Garry on the morning of the 8th.

No. IV.—During the 9th the pressure increased steadily on the Pacific coast, and on the 10th the rise was transferred to the Plateau regions; Salt Lake barometer in the afternoon 0.37 above the normal. The area slowly dissipated in the Plateau districts during the 11th.

No. V.—This area first showed itself by a marked rise over the Upper Lake region during the 15th; Marquette barometer, p. m. of the 16th, 0.23 above the normal. The pressure remained nearly stationary until the 18th, when a new outflow of cold air from Manitoba transferred the centre to Minnesota; St. Vincent barometer, a. m. of the 19th, 0.47 above the normal. The highest pressure remained nearly unchanged, over the Lake Superior region from the 19th to the 22nd, when it moved eastward into Ontario, whence it slowly withdrew with gradually increasing pressure down the St. Lawrence valley; Father Point barometer the afternoon of the 25th, 30.52 or 0.56 above the normal. It slowly dissipated on the 26th in advance of low area No. XIII. Cautionary Signals were displayed during the 19th on the Texas coast; maximum wind reported: Indianola, NW. 36. The lowest temperature of the area was -23° at Fort Garry on the morning of the 22nd.

No. VI.—On the 17th the barometer rose rapidly in California, and on the 18th the pressure in the Southern Plateau district was considerably above the mean. Moving slowly eastward the area apparently united on the 19th in Texas with area No. V. The highest reading noted was at midnight of the latter date at Eagle Pass, 0.24 above the normal.

No. VII.—On the 24th the pressure in the Southern Plateau district, which for several days had been near the normal, rose at midnight to 0.18 above at Tucson. The pressure continued above the mean in Arizona and southern California until midnight of the 26th, when it moved eastward and united with high area No. VIII.

No. VIII.—was the most important high area of the month. It first showed itself by a barometric rise over the valley of the Upper Missouri during the 24th; the next morning the temperature at Fort Garry was -35° . The pressure remained nearly stationary until the 26th, when a second rise carried the pressure at Fort Buford to 30.97. The area covered the Missouri valley until the 28th, when it moved rapidly southeastward, being central in Texas on the 29th; midnight barometer at Eagle Pass 30.65 or 0.52 above the normal. A portion of the area remaining in Texas slowly dissipated, while another part moving northeastward covered the Atlantic slope with a pressure decidedly above the mean during the 31st; Cape Henry barometer that morning 0.30 above the

normal. Cautionary Signals were displayed on Lake Michigan on the 27th (highest velocity 35 miles at Milwaukee) and on the 29th (40 miles at Grand Haven). The minimum temperatures which prevailed during the passage of this area east of the Rocky Mountains were the lowest observed over the greater part of the country for many years. As the area moved southeastward on the morning of the 28th a minimum temperature of -44° was reported from Fort Garry. At that time the temperature of the Missouri and Upper Mississippi valleys, the Upper Lake region and the northern Rocky Mountain slope was below zero. On the morning of the 29th the area over which temperatures below zero prevailed was extended to include the Ohio valley and the northern parts of Indian Territory and Texas, while at Fort Benton, Montana, a temperature of -59° was observed. This temperature (that observed at Pembina on December 24th, 1879 being the same) is the lowest ever recorded in the United States, and is within 14.08 of the lowest ever reported on this continent; (British Arctic Expedition of 1875-76, $-73^{\circ}.8$ at Floeberg Beach, $82^{\circ} 27' N. 173^{\circ} 26' W.$ in March, 1876.) On the morning of the 30th, temperatures ranging from 0° to -56° were reported from the entire Lake region, the Ohio, Upper Mississippi and Upper Missouri valleys, the Rocky Mountain slope southward to include the northern parts of Texas and New Mexico, from the greater part of New England, from the Middle States, (except southeastern Virginia), from the western half of North Carolina and eastern Tennessee. On the 31st, temperatures below zero prevailed over substantially the same region with the addition of the greater part of New Mexico and portions of Texas and New England. On that and the preceding morning freezing temperatures prevailed over the entire United States except the Pacific coast region, the southern half of Florida, and the extreme southwestern portion of Arizona. The following temperatures in Arizona and the Gulf States are noted as of interest: Tucson 35° , Cedar Keys 22° , New Orleans 20° , Jacksonville 19° , Brownsville 18° , Mobile 14° , Montgomery 8° , Augusta 7° . Much damage was done by the low temperature of this area to the sugar cane in Louisiana and adjoining states. Timely and sufficient warning, however, was given to planters so that they could take such means as would save the largest possible amount of the cane.

Areas of Low Pressure.—Sixteen such areas appeared during December, 1880. The tracks of thirteen are shown by Chart No. I. An unusually large number of these areas, six in number, first appeared on the Pacific coast; four of the number crossed the continent. One area sprang up in the Lower Lake region, one in North Carolina, two in the Gulf of Mexico and three from the Rocky Mountain region: the three remaining probably developed in Saskatchewan. No. III, as a whole, was the most severe storm, being violent on the Pacific slope, accompanied by tornadoes in Missouri, and marked in the Lake region by the lowest pressures and highest winds of the month. Nos. X, XII and XIII caused strong gales off the Pacific coast, and in connection with the last-named area, most violent northeast to northwest gales prevailed from North Carolina to Nova Scotia during the 25th and 26th. No. XV was marked by very severe gales in the Gulf of Mexico and along the entire Atlantic coast during the 29th. This area moved with unusual rapidity, its velocity east of the 100th meridian averaging seventy-five miles per hour. The paths pursued by areas for the first half of the month were, through their whole extent and without exception, to the northward of the 40th parallel. During that time, the pressure over the country was comparatively low. During the latter half of the month, the pressure over the country at large, was decidedly above the normal and, at no time, gave way so as to permit the natural movement of the low-areas eastward. In consequence, the tracks of low-areas skirted the borders of the prevailing high pressures. The areas on the Pacific slope moved southeastward along the coast, and such as have crossed the continent passed southeastward through Texas, and skirting the northern coast of the Gulf of Mexico, moved northeastward along the Atlantic coast.

No. I—was a continuation of area No. XVI, described in the November REVIEW. Central in northwestern Minnesota on the 1st, it moved northeastward into Hudson Bay Territory.

No. II—sprang up suddenly in the Lower Lake region during the night of November 30th and December 1st, and moving rapidly eastward, passed off the Massachusetts coast that afternoon; New London barometer 0.53 below the normal. Its subsequent course was probably northeastward, as severe gales were reported south of Nova Scotia during the 2nd. Cautionary Signals were displayed during the 1st in the Lower Lake region and somewhat late along the Atlantic coast, northward of Cape May, while to the southward of that station, Off-shore Signals were displayed. These signals were partly justified; the greatest wind velocities reported: Cleveland, W. 28; Cape Henry, W. 36; Point Judith, NE. 54.

No. III.—This storm was unusually violent on the Pacific coast. Off Columbia river, heavy WSW. gales, veering to NW. were experienced from November 29th to December 3d, and off the coast of southern Oregon during the 2nd and 3rd; lowest barometer 29.12, reported by the steamer *Elder*. During the 2nd, along the entire coast of California, heavy southerly gales occurred, in which one or more vessels were lost. The storm apparently moving from the northwest, entered Oregon during the 2nd; Roseburg barometer that morning, 29.26 or 0.91 below the normal. Moving very slowly southeastward, it was central in Utah at midnight of the 3rd. Its passage through California and Nevada was marked by heavy rains. At San Luis Obispo the rain-fall of the storm was 4.65 inches and Mt. St. Helena 6.65. In the Sierra Nevada Mountains along the Central Pacific

railway, four feet of snow fell upon a level. Railway travel was somewhat delayed by dangerous land-slides and heavy snow. In western Oregon, the snow-fall was from 2½ to 3 feet, east of the Cascades. The storm being followed by low temperatures in the valley of the Columbia, so blocked that river by ice above the mouth of the Willamette as to prevent any navigation until after the 12th. Below the Willamette, navigation was seriously interfered with for several days by an ice-gorge on Willow bar, four miles long. From Utah, the area moved rapidly eastward with decreasing pressure, and was central the afternoon of the 4th, in the Lower Missouri valley; Omaha barometer 0.77 below the normal. At that observation, warm (the highest temperatures of the month) southerly winds with rain, prevailed in the east and south quadrants of this area while an abnormal barometric fall of 0.33 inch in the past eight hours was reported from Des Moines and a maximum temperature from Leavenworth of 59°. At the same time in the northwest quadrant, high-area No. II was rapidly advancing, its progress marked by high NW. winds with snow, and temperatures below zero in southern Dakota (Deadwood, -11°). At midnight of the 4th, barometric low-area No. II had moved rapidly northeastward to the Upper Mississippi valley, with abnormal barometric falls in eight hours of 0.28 at Davenport and 0.29 at Milwaukee, while the following high area caused an abnormal rise of 0.31 at Omaha and 0.35 at North Platte and a fall of 39° in temperature at Leavenworth during the same time. Consequent upon such rapid changes, numerous tornadoes occurred on the 4th in southwest Missouri. They are elsewhere described under the head of *Local Storms*. On the morning of the 5th, the area was central, with greatly decreased pressure in northern Michigan; Escanaba barometer 28.92 or 1.09 below the normal. At that time the storm over the Upper Lake region (in connection with high area No. II) was unusually severe; maximum wind-velocity at Milwaukee SW. 53 miles and Duluth NW. 47. As navigation had practically closed in the Lake region, few or no disasters occurred to shipping on the lakes. On that day, in connection with these areas, the maximum wind-velocities, the lowest barometric pressures and highest temperatures of the month occurred at nearly every station in the Lake region, the Ohio, Lower Missouri and Upper Mississippi valleys. Moving rapidly northeastward down the valley of the St. Lawrence, it had reached, with increasing pressure and diminishing violence, by the afternoon of the 6th, its northeastern limits. Signals were displayed for this area in the Lake region during the 4th and 5th, and along the Atlantic coast northward of Macon during the 5th. These signals were justified with but few exceptions, though ordered somewhat late for Lake Ontario, the North Carolina and Maine coasts. The following are the highest wind-velocities reported: Cape Henry SW. 27; Eastport SE. 28; Barnegat S. 34; Buffalo W. 41; Sandusky SW. 41; Port Huron SW. 42; Duluth NW. 47; Milwaukee SW. 53.

No. IV.—appears to have sprung up from the remains of No. III. As that area moved down the valley of the St. Lawrence on the morning of the 6th, the pressure fell in North Carolina; Kittyhawk barometer that afternoon, 0.37 below the normal. The track of the area is uncertain, but it probably moved northeastward to the Banks of Newfoundland in a course nearly parallel with the coast. The lowest pressure noted was at Sydney, C. B., the afternoon of the 7th, 29.39 or 0.54 below the normal. Cautionary Signals were displayed during the 6th and 7th, from Cape Henry to Cape Hatteras. A wind-velocity of 40 NW. was reported from the first-named station.

No. V.—first appeared the morning of the 7th, in Nebraska, and moving rapidly eastward, was central in Iowa at midnight; Des Moines barometer 0.18 below the normal. It moved thence with great rapidity and diminishing pressure to Georgian Bay; Parry Sound barometer a. m. of the 8th, 0.33 below the normal; it then followed an eastern course to the Atlantic ocean, and was south of Newfoundland on the morning of the 9th. Its centre was followed by strong westerly gales, with snow in the Lake region. Signals were displayed in the Lower Lake region from midnight of the 6th to midnight of the 7th and were fully justified: Erie SW. 28 miles and Rochester W. 31.

No. VI.—apparently developed in Manitoba during the 10th, and moving southeastward, was in Minnesota the morning of the 11th. Moving eastwardly with diminishing pressure, it was in Ontario at midnight of the 12th; Saugeen barometer 0.49 below the normal. It passed thence northeastward through the Canadian Maritime Provinces to the Gulf of St. Lawrence. Cautionary Signals were ordered for all the lakes except Ontario, but were not justified, although velocities above 20 miles were reported from nearly every station.

No. VII.—was apparently central to the northward of Ft. Buford at midnight of the 12th; moving southeastward with rapidly decreasing pressure, it was central the morning of the 14th over Lake Michigan; Escanaba barometer 0.67 and Grand Haven barometer 0.68 below the normal. It then passed northeastward to the Gulf of St. Lawrence (closely following the path of No. VI) which it reached the morning of the 16th. The pressure remained very low over the Maritime Provinces from the 16th until the 19th; Sydney barometer at p. m. of the latter date 0.74 below the normal, after which the pressure rapidly increased. Cautionary Signals were displayed in the Lower Lake region during the 14th, and were justified by the velocities: Port Huron W. 25; Sandusky SW. 29; Buffalo SW. 30. The signal displayed at Eastport on the 15th was also justified by a velocity of E. 36 miles.

No. VIII.—As area No. VII moved eastward during the 13th and 14th, the pressure over the entire country was considerably below the normal. At midnight of the latter date, the barometer

fell on the Rocky Mountain slope, and an area of slight energy was apparently central in western Nebraska. Moving slowly southeastward, it was in Indian Territory during the 15th. Remaining nearly stationary, it merged the following day, into low-area No. IX, with which it is subsequently described. The lowest pressure noted was 0.46 below the normal at Fort Gibson at midnight of the 15th. No Signals were displayed for this area, but south winds, ranging from 25 to 30 miles, were several times reported from Indianola from the 14th to the 16th.

No. IX.—This area apparently developed over the Pacific ocean northwest of Washington Territory. The pressure fell steadily on the North Pacific coast from nearly normal the morning of the 13th to 0.97 below it at Olympia on the morning of the 15th, and 1.02 below at Umatilla. The passage of this storm was marked by moderate rains in the North Pacific coast region from the 13th to the 15th, with light, southerly winds, which changed to a southwest gale near the mouth of Puget Sound as the area passed eastward. Moving southeastward with increasing pressure, it was central in Utah at midnight, and in Kansas on the morning of the 17th; Leavenworth barometer 0.47 below the normal. Moving nearly eastward, it passed off the North Carolina coast on the morning of the 18th. Cautionary Signals—justified, were displayed on the North Carolina coast during the 17th.

No. X—first appeared off the California coast on the 15th, its passage being marked by strong northwest winds, as reported by ship *Fresno*, 35° N., 126° W., and by heavy SW. gales experienced by the ship *Ella* to the northwestward of the *Fresno* that morning, followed in the evening by heavy WNW. squalls. During the night of the 16th and 17th, the barometer fell rapidly along the middle and southern coasts of California; San Francisco barometer the morning of the 17th, 0.59 below the normal. During the day, the area filled up. During its continuance, strong gales prevailed along the California coast, and at San Diego, one building was unroofed and other damage done.

No. XI—apparently developed over the Gulf of Mexico during the 18th and moving eastward across northern Florida on the 19th, passed northeastward and was central in North Carolina, with decreasing pressure, the afternoon of the 20th; Cape Lookout barometer 29.50 or 0.61 below the normal. Continuing in a northeasterly course it was probably to the southward of Newfoundland at midnight of the 22nd. Cautionary Signals were displayed in the eastern half of the Gulf of Mexico and along the entire Atlantic coast during the 19th and 20th and were continued as Cautionary in New England and Off-shore from New York southward during the 21st. These signals were justified save at scattered stations. This storm was unusually severe along the Middle Atlantic coast from New York to Macon. High northeasterly gales with low temperatures and heavy snow or rain made it particularly dangerous. The following are the highest velocities reported: Cedar Keys, NW. 30; Eastport, NE. 30; Cape Lookout, SE. 48; Delaware Breakwater, NE. 48; Cape Henry and Chincoteague, NE. 60; Point Judith, NE. 65.

No. XII.—During the 18th the pressure fell off the North Pacific coast, and at midnight this area was apparently to the westward of Oregon. The track of this storm is uncertain, but it probably moved southeastward in a course nearly parallel with the California coast during the 19th and 20th, and filled up on the morning of the 21st. The lowest pressure reported was on the 20th, from San Francisco, 29.72 or 0.41 below the normal. The ship *Ella*, but a short distance southwestward from San Francisco, experienced at 3 a. m. of the 17th, a light southeast breeze which at 8 p. m. had increased to a violent gale; barometer down to 29.55; at 10 p. m. wind lulled and backed gradually to NW.

No. XIII—appeared, likewise on the Pacific coast during the 22nd; Roseburg barometer at midnight, 0.50 below the normal. Moving southeastward through Utah and Colorado, it entered the Gulf States during the 24th; lowest pressure at midnight 29.99 at Mobile. Central the morning of the 25th in Georgia, it moved northeastward with rapidly decreasing pressure, and was off the North Carolina coast at midnight; Cape Lookout barometer 0.46 below the normal. Following a northeasterly course nearly parallel to the coast with continually decreasing pressure, it was off the Nova Scotia coast at midnight of the 27th; Halifax barometer 29.07 or 0.88 below the normal. Signals were displayed during the 25th and 26th (as off-shore along the North Carolina coast on the latter date) from Smithville to Eastport. The storm was one of unusual violence during the 25th along the New Jersey and North Carolina coasts, and on the 26th along the New England coast. Commencing with strong northeast gales and rain, they soon backed to violent northwesterly gales with heavy snow and low temperatures. Fortunately the wind was off-shore most of the time and but few shipwrecks occurred. At Delaware Breakwater the wind attained a velocity on the 25th of NE. 52 miles, and two vessels were wrecked within the harbor. On the 26th the wind at Thatcher's Island attained the remarkable velocity of 84 miles East. Other high velocities reported were as follows: Cape Hatteras and Kittyhawk, NW. 40; Wood's Holl, NE. 40; New Haven, NE. 48; Cape Henry, NW. 56; Shoreham, NE. 64 and Sandy Hook, NE. 68.

No. XIV—was an unimportant depression which during the 26th and 27th moved from Manitoba eastward to Ontario, too far northward to permit of its course being accurately charted.

No. XV—appeared on the Oregon coast during the 26th; Roseburg barometer the morning of the 27th 0.37 below the normal. Its movement thence was very rapid and though decidedly abnormal, was very similar to that of low area No. XIII of this month and No. XV of December, 1877. Its

centre was apparently that afternoon (27th) in southwestern Idaho, at midnight in Utah and on the following morning in western Texas; Stockton barometer at last report 0.34 below the normal. On the afternoon of the 28th the lowest pressure was in the Rio Grande valley 0.32 below the normal. It moved thence eastward across the Gulf of Mexico and passing over northern Florida, followed, during the 29th, a northeasterly path, nearly parallel with, and at some distance from, the Atlantic coast. The lowest pressure noted on that day was at Cape Lookout, p. m. barometer 0.50 below the normal. Off-shore Signals were displayed on the Texas coast from the 26th to the 29th and Cautionary Signals in the Eastern Gulf and along the Atlantic coast as far north as Delaware Breakwater on the 28th and 29th. Cautionary Signals were also displayed from Cape May northward to Eastport, from the afternoon of the 29th to the morning of the 30th. These signals were fully justified by the following maximum velocities: Macon and Cape Lookout, NW. 32 miles; Pensacola, N. 40; Wood's Holl, NW. 43; Thatcher's Island, W. 42; Indianola, N. 51; Cape May, N. 52.

No. XVI.—During the 30th and 31st the pressure gradually decreased over the Gulf States and at midnight of the 31st the barometer at Punta Rassa was 0.11 below the normal.

INTERNATIONAL METEOROLOGY.

Three International charts, Nos. IV, V and VI, accompany the present REVIEW. No. IV is for the month of *November*, 1880, and Nos. V and VI for *April*, 1879.

Chart No. IV.—A *preliminary* chart, which indicates as well as is at present (January 12th, 1881) possible, the tracks of some of the principal storms over the North Atlantic Ocean and adjacent land-areas during the month of *November*, 1880. Up to the 11th the month was remarkably free from severe storms over the region indicated, but from the 12th onward terrific gales were experienced over the eastern portion of the Atlantic, in connection with areas Nos. IV, V, VI and VII, the more complete notice of which storms is reserved until the publication of chart No. VI for this month.

Chart No. V.—Upon this chart are shown the mean pressure, mean temperature, mean force and prevailing direction of the wind at 7.35 a. m., Washington mean time, (0.43 p. m., Greenwich mean time) for *April*, 1879, over the Northern and at certain stations in the Southern Hemisphere.

Pressure.—High pressures (30.20 in., or 767.1 mm., and above) prevailed only over the Atlantic Ocean, south of the 40th parallel, from near the African coast westward to near the Bermudas; Ponta Delgada 30.20 inches or 767.2 mm.; Bermuda, 30.22 or 767.6 (mean at 12 m. local time); Funchal, 30.27 or 768.9, the last mean being the highest reported during the month. The highest absolute reading reported by co-operating observers occurred at Barnaul, Siberia, on the 8th of the month—30.56 or 776.2. In the *Meteorological Bulletin of the Central Physical Observatory of St. Petersburg*, 30.94 or 785.9 is given as occurring at Irkutsk, Siberia, on the 6th, at 7 a. m. Low pressures (29.80 in., or 756.9 mm., and below) covered Hindostan, the British Isles, the greater part of Europe between the 40th and 60th parallels, the Canadian Maritime Provinces, and Behring's Sea. The lowest means reported were those of Hermannstadt, 29.61 or 752.0; Sitka, Alaska, (nine days only) 29.54 or 750.3. The lowest single pressure reported by a co-operating observer was 28.52 or 724.4 at Halifax, N. S., April 1st. As compared with that of the preceding month, (March, 1879,) the mean pressure over countries in the Northern Hemisphere, represented by international observers, showed a decided decrease. The line of no change ran from northern California on the Pacific coast eastward to Lake Superior, eastward and northward passing between the Faroe Islands, Scotland, to northern Norway, thence southward to the Baltic Sea, southeastward to the Ural Mountains, eastward to the Okhotsk Sea (south of the mouth of the Amoor river), and turning southward crossed central Japan to the Pacific. Northward of this line the pressure increased, the greatest change being reported from Stykkisholm, +0.24 in., or 6.1 mm. Southward of the line the pressure decreased, (except a slight rise over Morocco, the Maderias, Egypt, Asiatic Turkey, Persia, and the regions of the Black and Aral Seas.) In America this decrease—slight on the Pacific coast—was most marked to the eastward, being more than 0.10 inch or 2.5 mm. over the Gulf of Mexico and the southern half of the Mississippi valley. In New England and the Canadian Maritime Provinces the changes exceeded 0.20 in. or 5.1 mm., being —0.34 in. at Halifax, —0.31 at Sydney, Eastport and St. John's, N. F. It is probable that the area of —0.30 inch or 7.6 mm., included the Atlantic Ocean from say 43° to 48° north, and eastward from America to 20° west. The deviations over the Azores were —0.10 inch and over the Bermudas —0.17. In Europe the changes of —0.30, or 7.6 mm., occurred over southern England, the greater part of France, Belgium, Austria, Germany, northern Italy, and Poland in Russia. The most important changes were: Groningen, —0.29 in.; Agram and Greenwich, —0.30; Paris, —0.31; Geneva, Warsaw and Vienna, —0.32; Hamburg, —0.34 and Leipzig, —0.37. In northern Algeria the greatest change was —0.13 at LaCalle. In Asia the decrease was greater than 0.10 in China, northern Hindostan and southern Siberia. The following changes are noted: Zi-ka-wei, 0.15 inch, Pekin, 0.16; Barnaul, 0.18 and Lahore, 0.20.

The *General Barometric Range* during April, 1879, was 2.42 inches, or 61.5 mm., from 30.94 or 785.9 mm., to 28.52 or 724.4, on dates as noted above.

Temperature.—In Spain, Morocco, western Algeria and along the Pacific coast of the United States, the mean temperature was the same or *slightly below* that of the preceding month (March,